OPERATING INSTRUCTIONS

for

TYPE 1209-A UNIT OSCILLATOR

GENERAL RADIO COMPANY

CAMBRIDGE 39 MASSACHUSETTS

NEW YORK CHICAGO LOS ANGELES

U. S. A.

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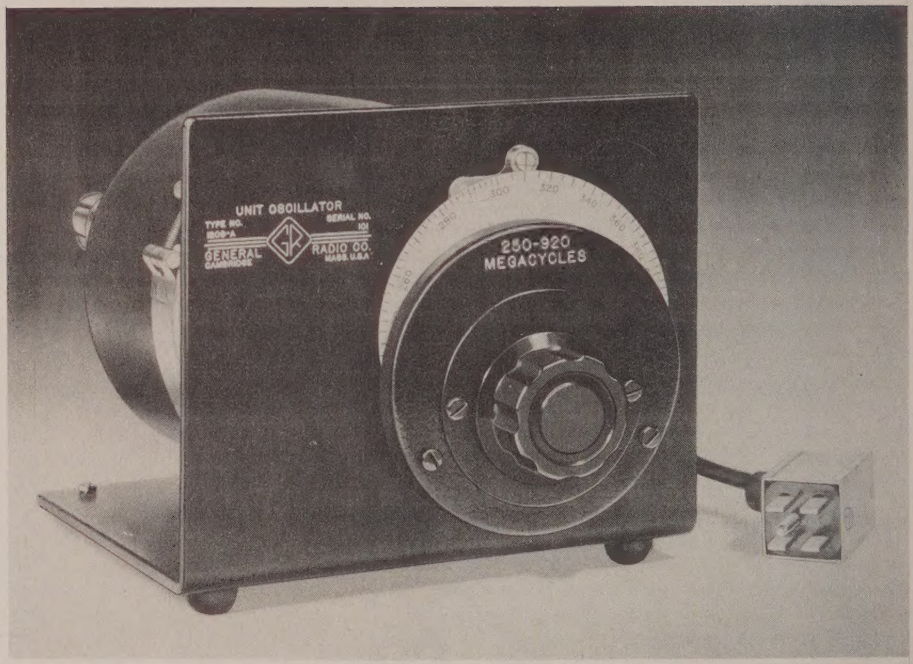

Figure 1. Panel View of the Type 1209-A U-H-F Unit Oscillator

SPECIFICATIONS

Frequency Range: 250 - 920 Mc.
Tuned Circuit: Butterfly, with no sliding contacts.
Frequency Control: 4-inch dial with calibration over 270°. Slow-motion drive, 4-1/2 turns.
Frequency Calibration Accuracy: ±1%.
Warm-Up Frequency Drift: 0.2%.
Output System: Short coaxial line with an adjustable coupling loop on one end and a Type 874 Coaxial Connector on the other. Maximum power can be delivered to load impedances normally encountered in coaxial systems.
Output Power: Into 50 Ω, 200 mw at any frequency.
Modulation: Amplitude modulation of 30% at audio frequencies can be produced by an external source of 40 volts. Input impedance is about 8000 ohms. Type 1000-P6 Crystal Diode Modulator can be used for modulation at video frequencies.
Power Supply Required: 300 v; 40 ma, dc
6.3 v; 0.4 a, ac
Type 1203-A Power Supply is recommended.
Tube: General Radio TUE-1 Disc-Seal Triode.
Mounting: Oscillator is mounted in an aluminum casting surrounded by a spun aluminum container. Assembly is then mounted on an L-shaped panel and chassis piece.
Accessories Supplied: Type 874-R20 Patch Cord multipoint connector, Type 874-P Panel Connector, and Type 874-C Cable Connector.
Accessories Available: Type 1000-P6 Crystal Diode Modulator, Type 1214-A Unit Oscillator, Type 874 Coaxial Elements such as attenuator, filters, coupling devices, stubs, voltmeter, and mixer.
Dimensions: 7 x 6-1/4 x 9-1/4 inches, over-all.
Net Weight: 5-1/2 pounds.

U. S. Patent 2,125,816. Patent Applied For.

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TYPE 1209-A UNIT OSCILLATOR

The Type 1209-A Unit Oscillator is a general-purpose power source for the radio-frequency laboratory. It covers the range from 250 - 920 Mc. It can be used to drive bridges, slotted lines, impedance comparators and other measuring equipment. In combination with a voltmeter and attenuator it provides an accurately known output voltage for receiver testing. Direct amplitude modulation over the audio-frequency range is possible, and amplitude modulation free from incidental frequency modulation, over the frequency range from zero to 5 Mc can be obtained with a simple crystal diode modulator. Connected to a mixer, the unit oscillator can be used as the local oscillator in a heterodyne receiver to convert a low-frequency communications receiver into a detector for v-h-f and u-h-f signals.

DESCRIPTION

The Type 1209-A Unit Oscillator covers the frequency range of 250 - 920 Mc. The tuning system is a "butterfly" circuit which combines a variable air capacitor and a variable inductor in a single unit with no sliding contacts. At the low-frequency end inductance and capacitance are approximately 0.012 μh and 40 $\mu\mu$f, and at the high-frequency end 0.004 μh and 7 $\mu\mu$f. The vernier dial makes about 4-1/2 turns for 270° rotation of the main dial. The rotor of the tuning unit is geared down for 80° rotation. The frequency calibration is accurate within $\pm$1%.

Plate and grid of the General Radio Type TUE-1 Oscillator Tube are connected to the tuned circuit, and the cathode is left floating. The oscillator circuit is of the Colpitts type with feedback determined essentially by the electrode capacitances of the tube. A small amount of cathode-plate capacitance has been added. The General Radio Type TUE-1 Oscillator Tube is a Phillips Type 5861 Triode which has been modified to fit this particular circuit.

The output system is a short coaxial line with a coupling loop on one end and a Type 874 Coaxial Connector on the other. Coupling between the loop and the oscillator can be adjusted over a wide range, and the loop can be clamped in the desired position. Maximum power can be delivered to load impedances normally encountered in coaxial systems.

The output power into a 50-ohm load is over 100 milliwatts at any frequency and 200 milliwatts up to 920 Mc.

A power supply of 330 volts at 36 milliamperes and 6.3 volts at 0.4 ampere is required to operate the oscillator at its maximum rating.

The Type 1203-A Unit Power Supply is recommended as a convenient and low-priced source of power. The multiconnector plug of the Type 1209-A Unit Oscillator plugs directly into this power supply.

For some applications a well-regulated power supply with low hum voltage will be found more desirable to avoid frequency variations caused by line voltage fluctuation and to produce a clearer beat note. For a 20% line voltage variation the frequency change is of the order of 0.01% up to frequencies of 600 Mc, and increases to 0.05% at the top end of the frequency range.

Amplitude modulation over the audio range can be obtained by superimposing a-f voltage in the d-c power supply. Convenient terminals have been provided for this purpose. Incidental fm inherent in this system is of the order of 0.01% for 50% am at carrier frequencies up to 400 Mc and 0.1% at the high-frequency end.

The Type 1214-A Unit Oscillator is recommended as a convenient, low-priced source of power for 30% modulation at 400 or 1000 cycles.

OPERATION FROM TYPE 1203-A UNIT POWER SUPPLY

The Type 1209-A Unit Oscillator is shipped with the oscillator tube in place and ready for use. Individual adjustments have been made on the oscillator to fit the tube supplied for operation from the Type 1203-A Unit Power Supply. Series and shunt resistors have been included in the oscillator plate circuit to prevent overloading of the oscillator tube under various conditions of load and line voltage.

Frequency and output are adjusted readily by setting the frequency dial and rotating the output coupling loop after loosening the large wing nut at the rear end of the shield. For low output the coupling loop can be partly withdrawn.

For amplitude modulation the audio modulating voltage is inserted at the two terminals at the side of the base. The full plate current has to flow through the modulating source. About 40 volts modulating voltage are required for 30% modulation. The input impedance is about 8,000 ohms.

The output terminal is the new Type 874 Coaxial Connector which was described in the October 1948 issue of the General Radio Experimenter. It is ideally suited for use on coaxial measuring equipment and was specifically designed for this purpose.

A 3-foot, 50-ohm coaxial cable is used to make connections to the oscillator after one of the two connectors supplied has been installed on the equipment under test.

Three adaptors are available to make connections to systems using Type N Connectors, the older General Radio Type 774 Connectors, or binding posts and terminals.

ADJUSTMENTS FOR OTHER POWER SUPPLIES

If the Type 1203-A Unit Power Supply is not used, similar operating conditions will be obtained with a power supply of 330 volts at 36 milliamperes and 6.3 volts at 0.4 ampere connected to the power cable.

To reduce the power supply requirements the series and shunt resistors in the base of the oscillator could be disconnected, but care has to be taken not to overload the tube under various operating conditions.

Plate dissipation of the Type TUE-1 Oscillator Tube should be limited to 5 watts and best operation will be obtained with a plate current of 30 milliamperes at 165 volts. Plate current can be adjusted by the variable grid resistor, R-3, located on the base of the oscillator. This resistor is accessible through a hole in the base plate.

MAINTENANCE

If the oscillator tube is replaced, resistor R-3 may have to be readjusted as outlined above to obtain maximum output and to limit plate current and plate dissipation.

The frequency calibration may be slightly changed at the high-frequency end by a change of the oscillator tube. It can be restored by adjusting the FLEXIBLE TAB located on the plate connector. Before any adjustment of this trimmer capacitor is made, the oscillator should be allowed to warm up, since the warm-up drift may be as much as 0.2%. The oscillator shield has a large effect on frequency, particularly at the low-frequency end.

If the calibrated dial is removed it can be restored to the original position by using the short reference mark (beyond the high-frequency end) which corresponds to the internal stop of the shaft.

ACCESSORIES AVAILABLE

A large selection of Type 874 Coaxial Elements is available to increase the utility of the unit oscillator. These accessories are part of a complete integrated line of measuring equipment for the determination of voltage, power and standing-wave ratio at v-h and u-h frequencies.

While the unit oscillator is primarily intended as a source of power for this measuring equipment, and for two other impedance measuring devices, the Type 1601-A V-H-F Bridge and the Type 1602-A U-H-F Admittance Meter, many of the coaxial elements serve as accessories to the unit oscillator to adapt it to various applications in the radio-frequency laboratory to substitute for more expensive equipment that is not always available.

Three of these applications are described in detail below, and others will suggest themselves after a study of the complete list of Type 874 Coaxial Elements, which was published in the January 1950 issue of the General Radio Experimenter.

Particularly useful are some of the small parts as connectors, cables, adaptors, terminations, attenuators and coupling units, which can be plugged together in various combinations for many different setups.

UNIT OSCILLATOR AS SIGNAL GENERATOR FOR RECEIVER TESTING

Since the unit oscillator is a well-shielded source of power, it can be used as a signal generator for receiver testing if means are provided to measure and to attenuate the output. The Type 874-VR Voltmeter Rectifier, the Type 874-VI Voltmeter Indicator and the Type 874-GA Adjustable Attenuator are suitable for this purpose and should be connected to the unit oscillator as shown in Figure 2. In addition to these three instruments, a Type 874-D50 Adjustable Stub is required to produce a current maximum at that point of the attenuator where the adjustable output loop is coupled.

To increase the output to a value that can be read on the voltmeter, a tuning element between the oscillator and the attenuator is required. At the higher frequencies coverage is obtained conveniently by a Type 874-LA Adjustable Line. At lower frequencies various lengths of line have to be added in addition.

Current from the unit oscillator is fed through the attenuator into the short circuit at the stub. The attenuator is calibrated in db. At minimum attenuation the attenuator output is measured by a crystal diode in the voltmeter rectifier and read on the meter of the voltmeter indicator. Means are provided to standardize the crystal indication. The crystal is followed by a 50-ohm resistor which determines the output impedance.

The arrangement just described is similar to the one used in the General Radio Type 1021-A Standard-Signal Generator. The maximum available output is of the order of several tenths of 1 volt. The calibration of the attenuator

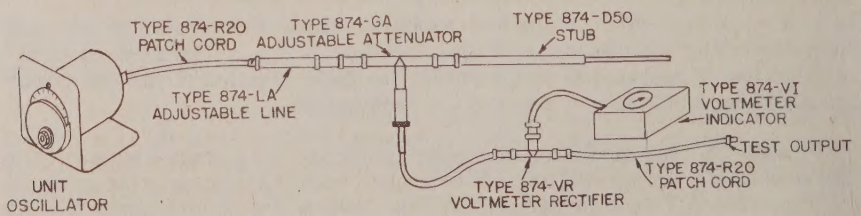


Figure 2. Functional Diagram of the Unit Oscillator and Accessories, Connected to Work as a Standard-Signal Generator.

covers 120 db, but the shielding of the unit oscillator and the various other components is not sufficient to make accurate measurements in the microvolt region.

UNIT OSCILLATOR AS TELEVISION SIGNAL GENERATOR

In combination with a Type 1000-P6 Crystal Diode Modulator and a Type 874-GF 20-db Fixed Attenuator the unit oscillator is a convenient source of television signals over its entire carrier-frequency range if video modulating voltage is available. The circuit arrangement is shown in Figure 3. The modulating voltage required can be obtained from a standard television receiver tuned to the local station.

Since the modulator is separated from the oscillator by an attenuator pad, amplitude modulation free from incidental-frequency modulation is obtained. The output is of the order of 10 millivolts.

UNIT OSCILLATOR AS FREQUENCY CONVERTER

Connected to a Type 874-MR Mixer Rectifier, the unit oscillator can provide the local signal in a heterodyne converter, to adapt a low-frequency communications receiver for use as a sensitive detector for v-h-f and u-h-f signals. This circuit is shown in Figure 4. Without additional tuning the conversion loss is approximately 12 db at an intermediate frequency of 30 Mc. The bandwidth of the communications receiver should be at least 20 kilocycles to allow for frequency fluctuations of the received signal and of the unit oscillator.

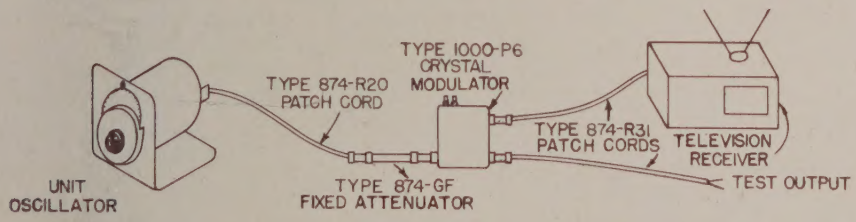


Figure 3. Functional Diagram of the Unit Oscillator with Video Modulator to Form a Television Signal Generator.

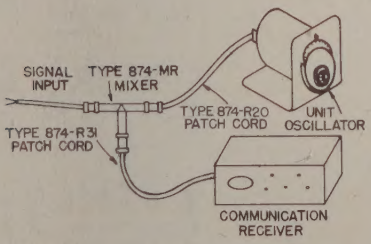
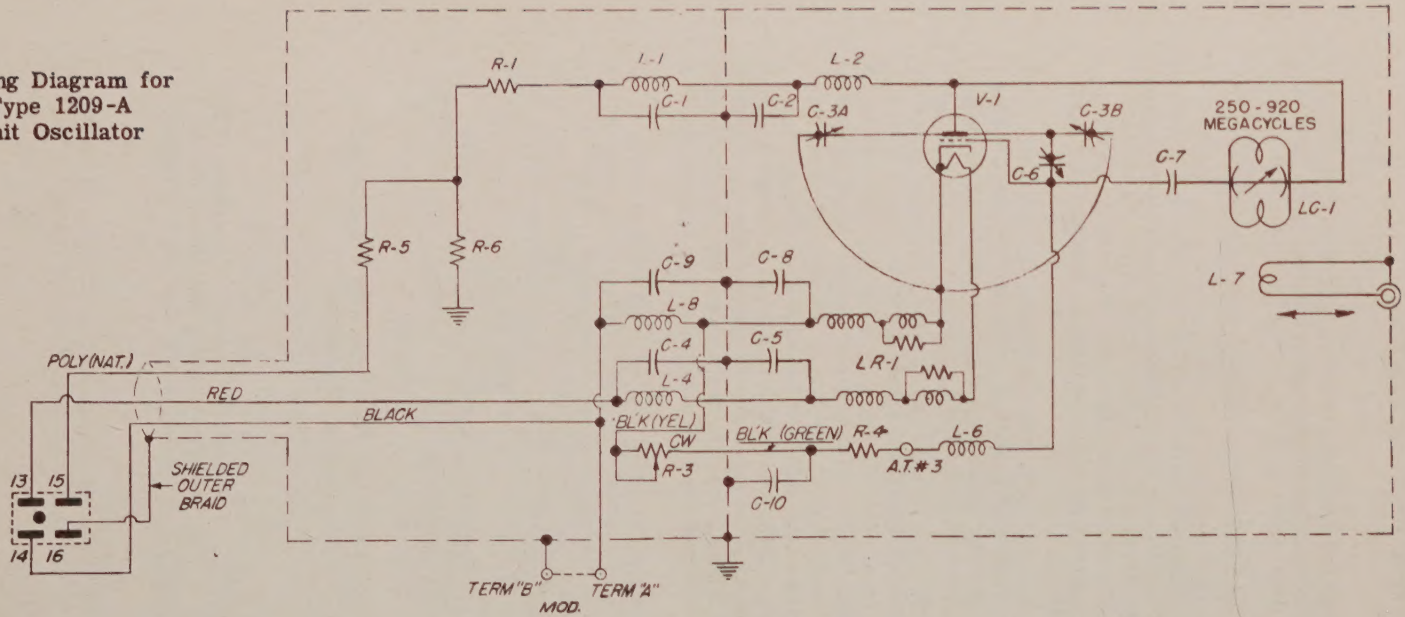


Figure 4. Functional Diagram of the Unit Oscillator and Mixer Rectifier Used as a Frequency Converter.

Wiring Diagram for Type 1209-A Unit Oscillator



RESISTORS

R-1 = 560 Ohms	±10%		REW-6C
R-3 = 5 K Ohms	±10%		POSW-862
R-4 = 1.0 K Ohms	±10%		REC-21BF
R-5 = 4.5 k Ohms	±10%		REPO-35
R-6 = 22 k Ohms	±10%		REPO-36

INDUCTORS

L-1 = 45 μh		ZCHA-9
L-2 = 45 μh		ZCHA-9
L-4 = 20 μh		ZCHA-29
L-6 = 45 μh		ZCHA-9
L-7 = R.F. Pick-Up Loop		874-403
L-8 = 20 μh		ZCHA-29

CONDENSERS

C-1 = 200 μμf		COU-24
C-2 = 200 μμf		COU-8-2
C-3A = Built in (Air) Adj.		
C-3B = Built in (Air) Adj.		
C-4 = 500 μμf		COU-24
C-5 = 500 μμf		COU-8-2
C-6 = Built in (Air) Adj.		
C-7 = 10 μμf	Built in (Mica)	
C-8 = 500 μμf		COU-8-2
C-9 = 500 μμf		COU-24
C-10 = 200 μμf		COU-8-2

MISCELLANEOUS

LC-1 = Butterfly 250-920 Mc Built in

LR-1 = Heater Filter Assembly 1021-216

PL-1 = Plug CDMP-12-4

TUBE

V-1 G.R.Co. TYPE TUE-1